Supporting Information

Physical Interpretation and Implications of Convective Impulses in Thunderstorms Based on Lightning and Polarimetric Radar Observations

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Affiliations

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Figures S1 to S5

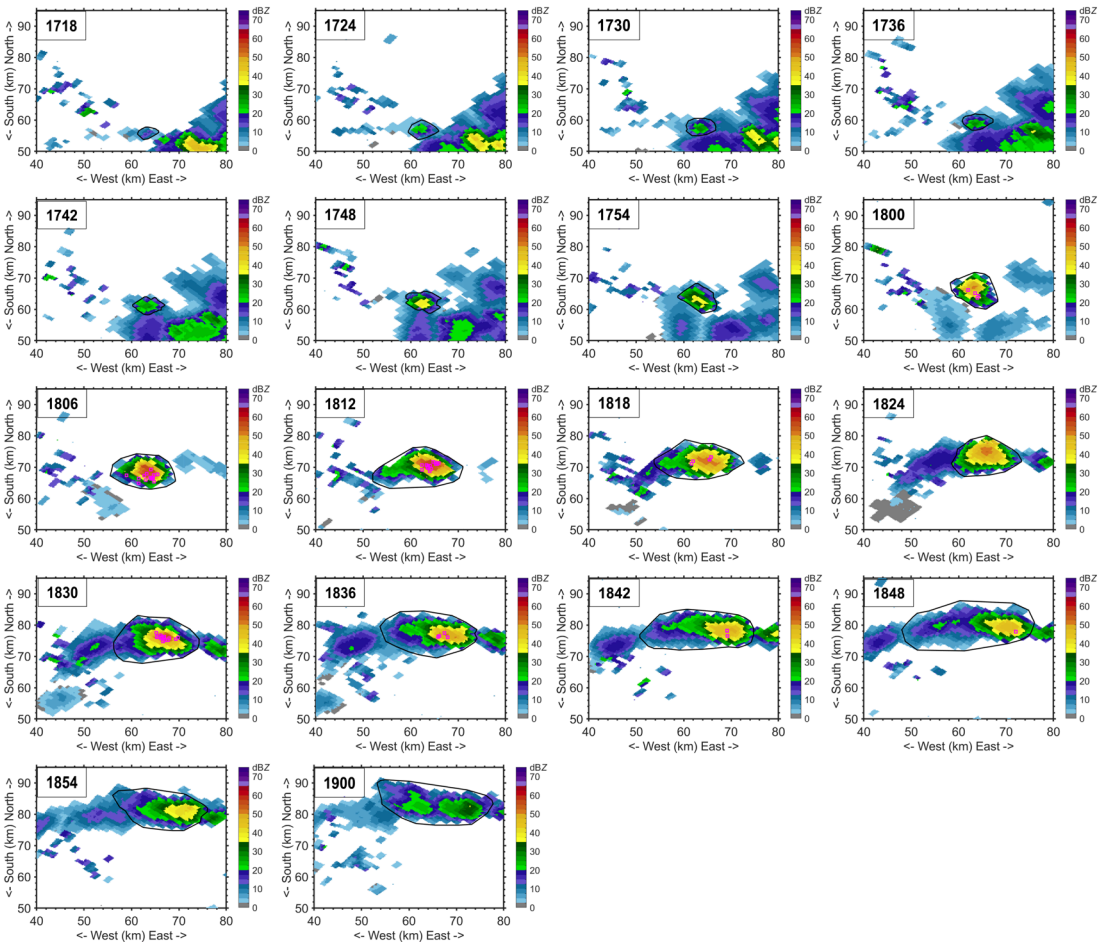
Figure S1. Evolutionary cycle of thunderstorm cell A. Composite reflectivity for the evolutionary cycle (from 17:18 to 19:00 local time) of the isolated thunderstorm cell (case A, which occurred on 20 June 2016). The black line indicates the approximate boundary of this thunderstorm. The pink square indicates the first source location of one lightning flash.

Figure S2. Evolutionary cycle of thunderstorm cell B. Composite reflectivity for the evolutionary cycle (from 11:42 to 14:00 local time) of the isolated thunderstorm cell (case B, which occurred on 13 June 2016). The black line indicates the approximate boundary of this thunderstorm. The pink square indicates the first source location of one lightning flash.

Figure S3. Locations of the detection systems and analyzed area. The white star indicates the Guangzhou S-band polarimetric radar (GZ radar); the black circles represent distances from the GZ radar site of 25 and 100 km. The orange dots indicate the 10 sensors of the Low-Frequency E-field Detection array (LFEDA); the orange circle indicates the distance from the center of the LFEDA network to 70 km. The blue dots indicate the three ground sites used for detecting aerosol concentrations. The blue diamond indicates the Qingyuan meteorological observatory. The analyzed area is restricted to the regions of overlapping coverage between the GZ radar radius of 25−100 km and the LFEDA station network center radius of 70 km.

Figure S4. Output of the Weather Research and Forecasting (WRF) model. Two sensitivity experiments are conducted to investigate the impacts of raindrop breakup on the number concentration of graupel and on the convective intensity (updraft velocity) within clouds. In the first experiment, raindrop breakup is considered (hereafter RB); in the second experiment, none of the raindrop breakup parameterization are used (hereafter noRB). This figure shows the evolution of reflectivity from 13th minute to 18th minute in the RB experiments. The black lines indicate the 0°C, −10°C, −20°C, and −30°C isotherm heights.

Figure S5. Output of the Weather Research and Forecasting (WRF) model. This figure shows the evolution of z-wind component from 13th minute to 18th minute in the RB experiments. The black lines indicate the 0°C, −10°C, −20°C, and −30°C isotherm heights.



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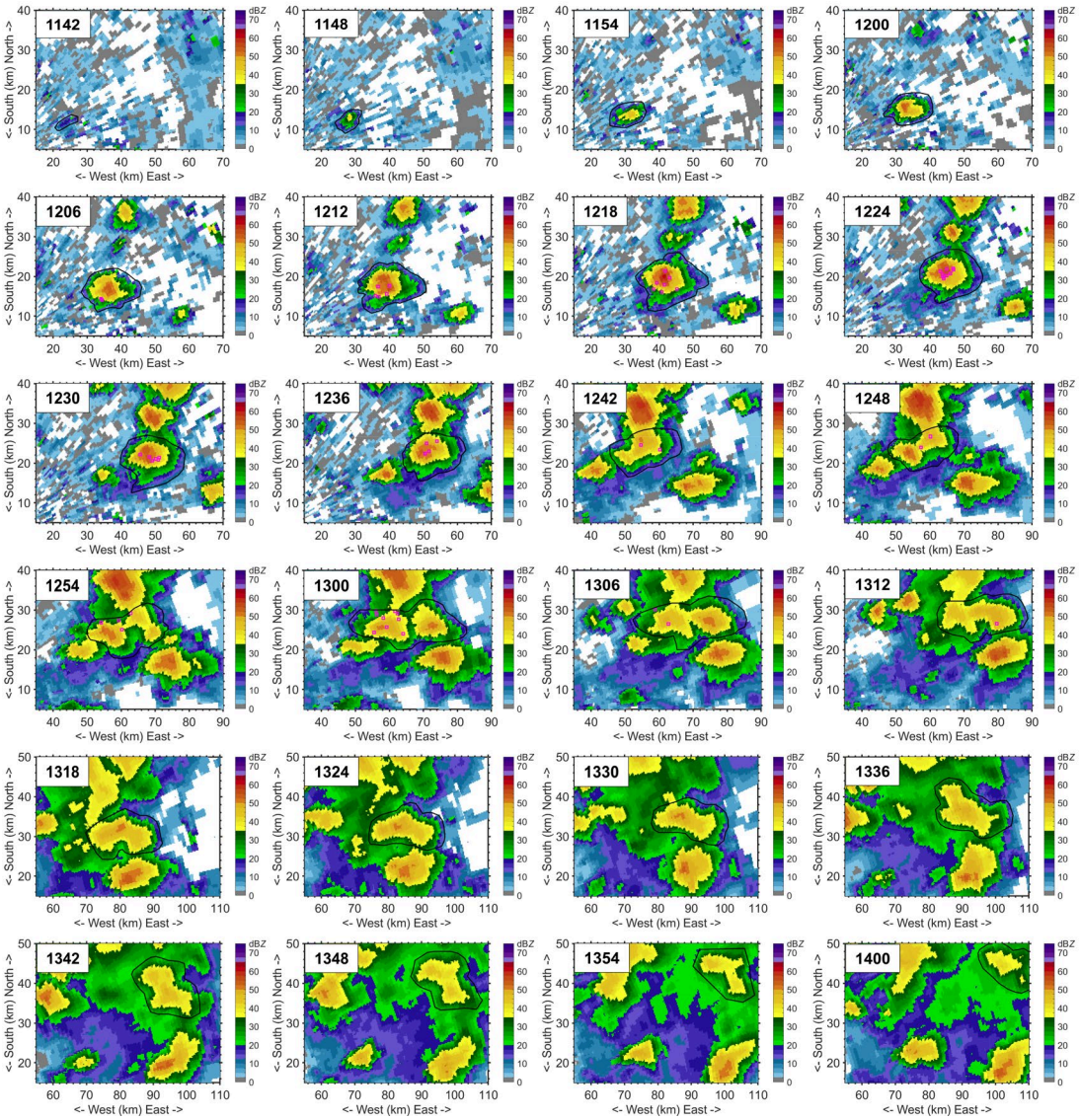
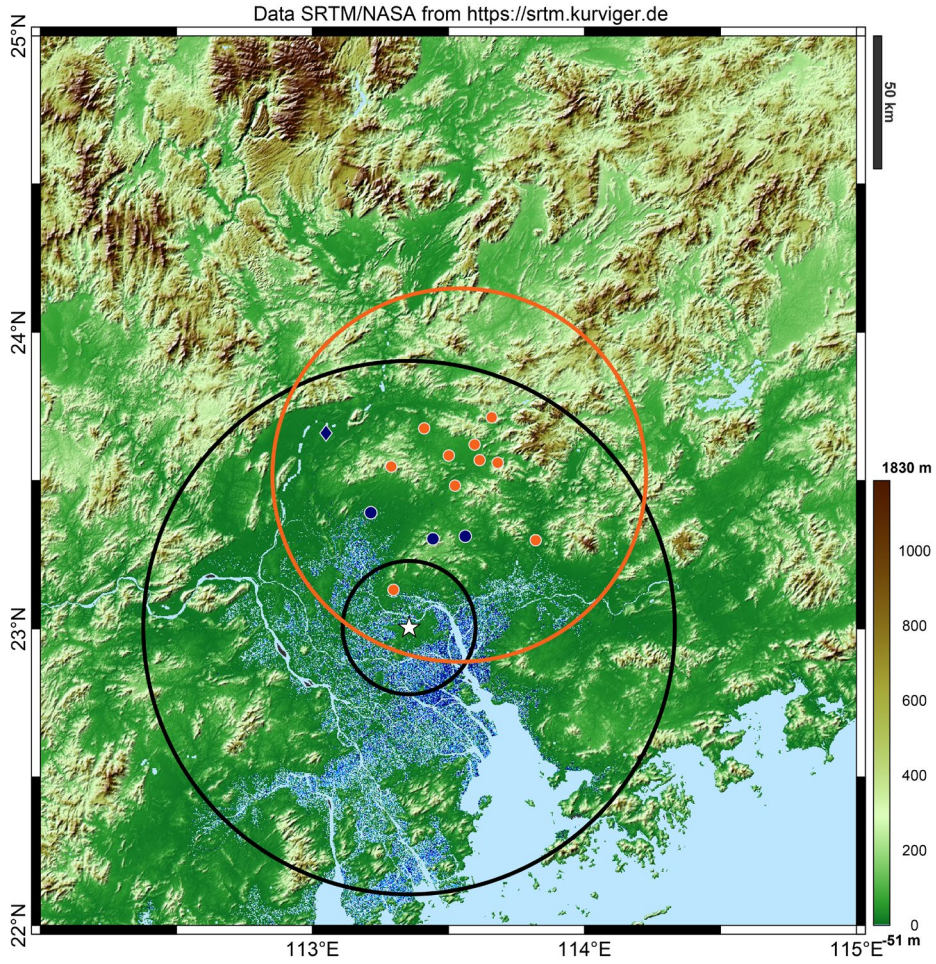


Figure S2. Evolutionary cycle of thunderstorm cell B. Composite reflectivity for the evolutionary cycle (from 11:42 to 14:00 local time) of the isolated thunderstorm cell (case B, which occurred on 13 June 2016). The black line indicates the approximate boundary of this thunderstorm. The pink square indicates the first source location of one lightning flash.



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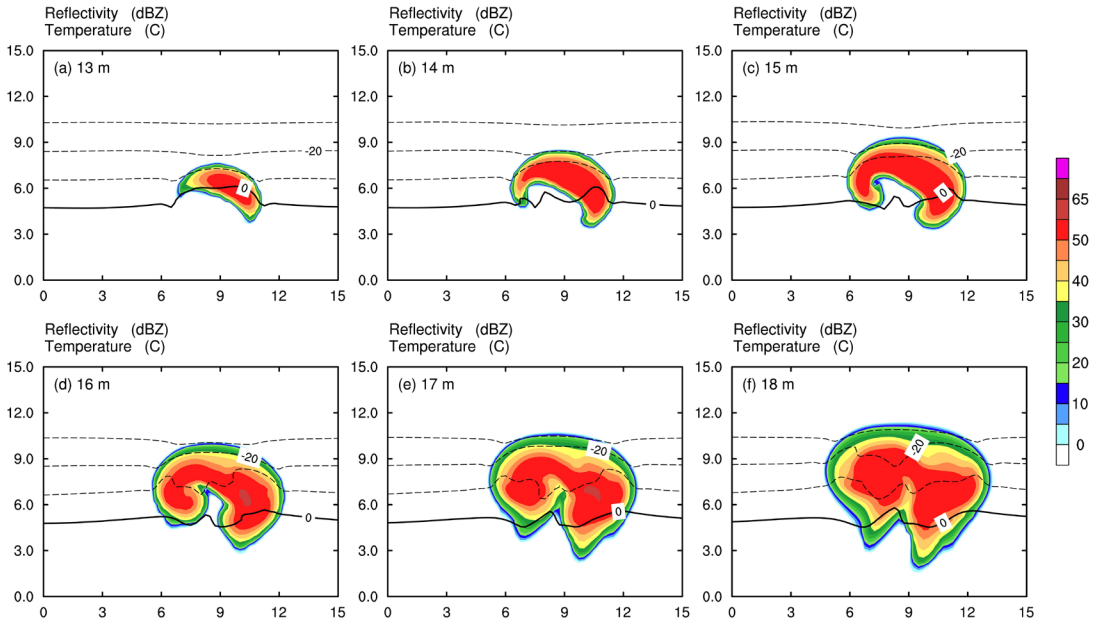

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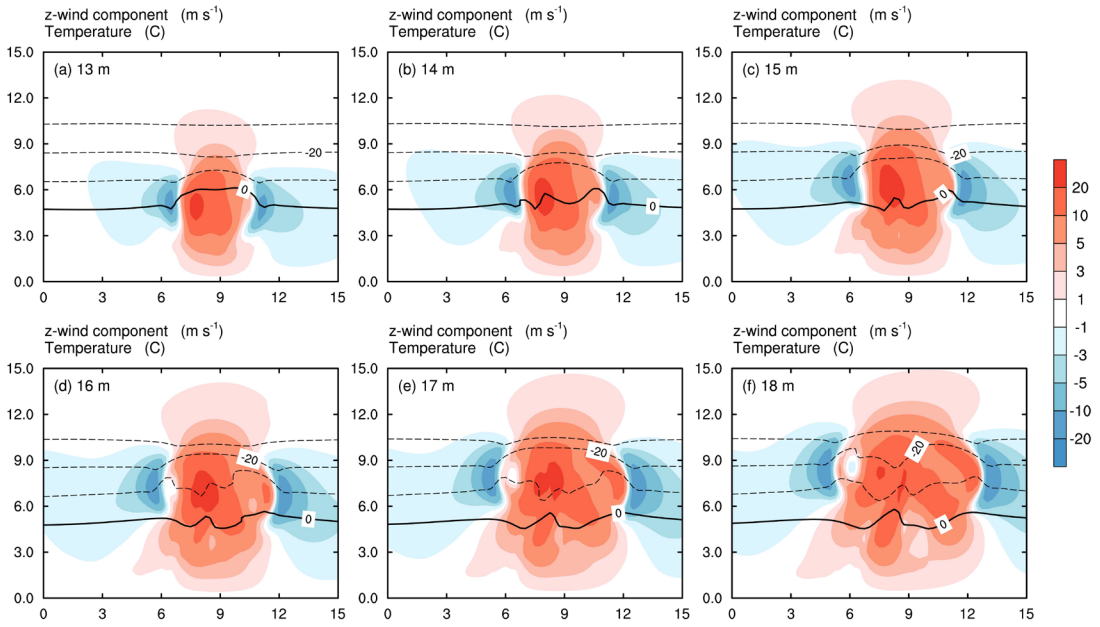

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